Endogenous electric currents might guide rostral migration of neuroblasts.

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Funding Grants: Directing migration of human stem cells with electric fields

Public Summary:
In order to repair damaged brain tissue, neural stem cells need to migrate to the lesion sites to carry out their function of regeneration. How the directional migration is achieved and if it can be enhanced is a critical question yet to be answered. We found that there are electrical paths in the brain that forms channels in which direct electrical currents flow, and the neural stem cells follow the electrical gradients to migrate. We propose that in the brain there might be electrical corridors in which neural stem cells follow the voltage gradients and migrate. This novel mechanism if proved to be true, will have significant implication in many important neurological diseases where migration of neural stem cells is impaired. It may be possible to use this novel mechanism to mobilize and guide neural stem cells to repair brain damage due to diseases or injury.

Scientific Abstract:
Mechanisms that guide directional migration of neuroblasts from the subventricular zone (SVZ) are not well understood. We report here that endogenous electric currents serve as a guidance cue for neuroblast migration. We identify the existence of naturally occurring electric currents (1.5+/-0.6 muA/cm(2), average field strength of approximately 3 mV/mm) along the rostral migration path in adult mouse brain. Electric fields of similar strength direct migration of neuroblasts from the SVZ in culture and in brain slices. The purinergic receptor P2Y1 mediates this migration. The results indicate that naturally occurring electric currents serve as a new guidance mechanism for rostral neuronal migration.